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**UNITED STATES PATENT APPLICATION**

**OF**

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**FOR**

**OBJECT HAVING A DECORATIVE PATTERN AND METHOD OF APPLYING THE  
DECORATIVE PATTERN**

[001] The present invention relates to an object having a decorative pattern on at least a portion of its surface, for example, a stopper with a decorative pattern as commonly used on containers for perfumes or other cosmetic products. The invention also relates to a method for producing a decorative pattern on such an object. The decoration may include a logo, a brand mark, a design or any other inscription or distinctive sign.

[002] In the field of cosmetics, particularly for packaging perfumes or scents, use is made of decorated stoppers, for example stoppers with a gold or chrome finish on their entire outer surface or on just part of it, so as to reveal a decoration or a design.

[003] One of the techniques used to achieve such a decoration or design includes metallically coating the plastic part, protecting those parts that are not to be coated with, for example, a varnish, and then possibly removing the varnish.

[004] According to another manufacturing technique, the plastic part that is to be coated with metal is obtained by molding two plastics compatible with one another, one of them being capable of being coated with a metal and the other not. This technique does, however, have tremendous practical difficulties with its implementation. Furthermore, it is expensive, particularly as regards the construction of the molds, and the results obtained are not entirely satisfactory in that it is difficult to obtain clear-cut boundaries where the two plastics meet. Furthermore, it offers little room to maneuver as far as the choice of the decoration that can be produced is concerned.

[005] Patent application FR-A-2 751 265 describes a method in which an object is formed of a metal coatable material, such as an ABS (acrylonitrile butadiene styrene), a PP

(polypropylene), a POM (polyoxymethylene) or a filled polyester. A sheet of a non-coatable material such as a PVC (polyvinyl chloride) or PC (polycarbonate) is overmolded on the part. Next, galvanoplasty is used to deposit a metallic coating on those areas of the part that are not covered by the sheet. A method such as this is relatively complicated and expensive to implement. Furthermore, as with the technique described earlier, the possibilities with regard to the decorations that can be achieved are limited.

[006] Aside from the methods mentioned hereinabove, there are many other decorating methods that differ according to the material used. As far as plastics are concerned, mention may be made of methods involving screen printing, pad printing, ink jet printing, hot transfer or molding. The decoration can also include a label stuck onto the object that is to be decorated.

[007] Laser marking is a particular form of numerically-controlled marking. Laser marking may be particularly advantageous on account of its cleanliness, the recyclability of the marked part, the permanency of the inscription, the flexibility it has to offer--particularly in the choice of decoration and its customization, the resolution it can achieve and also because of how economical it can be to implement. Furthermore, lasers can allow decoration to be done from a distance, that is to say without the object to be decorated being brought into physical contact with a printing member.

[008] Patent application FR-A-2 778 919 describes a method for using a laser to mark or etch a part formed of a polymer filled with inorganic pigments and coated with a layer of chitin or chitin derivatives. A method such as this has a certain number of

restrictions, particularly in regard to the color and appearance that can be achieved for the decoration.

[009] One of the optional subjects of the invention is to produce an object bearing a permanent decoration, wherein the object may be simple and economical to produce.

[010] Another optional subject of the invention is to produce an object on which a decoration can be fixed, regardless of the geometry of the object to be decorated.

[011] Yet another optional subject relates to a method for marking an object made of thermoplastic, for example, a stopper for a container, wherein the method may be simple and economical to implement.

[012] Still other optional subjects may become apparent from the following description. It should be understood that certain aspects of the invention could be practiced without accomplishing one or more of these optional subjects.

[013] According to one aspect of the invention, an object formed from a support obtained by molding a material that can be metallically coated by electrodeposition may be provided. The support may be, on at least part of its surface, covered with a first metallic coating formed of the superposition of  $n$  ( $n \geq 2$ ) layers of metal and at least partially delimiting a decorative pattern. The support may be covered on the surface corresponding to the decorative pattern with a second metallic coating formed of at most  $n - 1$  layers of metal. An outer metallic layer of the first metallic coating may be of a color and/or appearance that differs from the color and/or appearance of a metallic outer layer of the second metallic coating.

[014] The decorative pattern may include a text, a brand mark, a logo, a design or any other pattern. The metallic surface of the decorative pattern, in combination with the metallic surface which delimits it, may provide aesthetic features. Optionally, many contrast and color combinations can be obtained simply by altering the choice and arrangement of the layers of metal of which the first and second metallic coatings are respectively formed.

[015] In one embodiment, the support may be metallically coated by electrodeposition or galvanoplasty when the support is made of plastic. The support from which the object is formed may be obtained by molding a material that can be coated by electrodeposition or galvanoplasty. By way of example, mention may be made of zamac, ABS (acrylonitrile butadiene styrene), PP (polypropylene), POM (polyoxymethylene) or a polyester, each of these being optionally filled.

[016] The outer layer of the first metallic coating may be formed of a first metal chosen, for example, from chromium, silver, gold and zinc. The outer layer of the second metallic coating may be formed of a second metal, different from the first and chosen, for example, from chromium, nickel, silver, gold, zinc, copper and an alloy, such as bronze.

[017] The object obtained according to the invention may be a container, for example, chosen from a case, a bottle, a pot, and a jar. The object also may be an accessory intended to be associated with such a container, for example, a stopper for the container. The decorative pattern may be formed on at least one of the container and the stopper.

[018] The object may form a stopper for a container intended, for example, to package a cosmetic product. The stopper may be formed of a transverse wall and a lateral skirt, for example, a cylindrical skirt extending from the transverse wall. The decorative pattern may be formed on the transverse wall and/or on the lateral skirt.

[019] According to another aspect of the invention, a method for producing a decorative pattern on an object formed of a support obtained by molding a material that can be metallicity coated by electrodeposition or galvanoplasty is provided. The method may include using electrodeposition or galvanoplasty to deposit on at least part of the support a coating formed by superposition of at least two layers of metal, an outer layer of which is formed of a first metal, and optionally using a laser beam to eliminate at least a portion of the outer layer of the coating on the surface corresponding to the decorative pattern so as to reveal, on the surface, a layer formed of a second metal of a color and/or appearance that differs from the first metal.

[020] The laser used may be a laser of YAG type, which can provide a short wavelength (1.06  $\mu\text{m}$ ) that may be readily absorbed by most non-metallic materials, for example, a thermoplastic which may be used according to the invention.

[021] The method according to the invention may have many optional features. Marking may be quick (e.g., the cycle time, depending on the decoration and on the object, may be of the order of a few seconds). The resolution of the produced image may be of good quality (e.g., of the order of a few  $\mu\text{m}$ ). Furthermore, it may be possible to decorate non-planar surfaces or those that would be difficult to access using conventional screen

printing or labeling techniques. The object to be decorated may be marked from a distance, without contact with the marking device. Such a technique of decorating by laser can be implemented in industrial installations turning out objects using equipment such as conveyors, robot arms, turntables, or any other means commonly used in industrial circles.

[022] When an object is being marked with a laser beam, the object to be decorated may be stationary, and the laser beam may be moved around according to the decoration to be produced. Alternatively, the laser beam may be stationary and the object may be moved around according to the decorative pattern to be produced.

[023] By way of non-limiting example, the first and second metals may be chosen from the following metals or alloys: copper, nickel, chrome, silver, gold, zinc, and bronze. Other metals may be used, depending on the colors, appearance or contrast desired.

[024] According to one aspect of the invention, an object including at least one decorative pattern is provided. The object may comprise a support formed of molded material and a first metallic coating covering at least part of a surface of the support. The first metallic coating may be formed of at least  $n$  superposed layers of metal, wherein  $n \geq 2$ . The first metallic coating may at least partially delimit a decorative pattern, and a second metallic coating may cover the surface of the support in a region corresponding to the decorative pattern. The second metallic coating may be formed of a maximum of  $n-1$  layers of metal, wherein an outer metallic layer of the first metallic coating has at least one of a color and an appearance differing from that of an outer metallic layer of the second metallic coating.

[025] According to another aspect of the invention, the object may be configured in the form of a container.

[026] According to another aspect of the invention, the object may be configured in the form of an accessory intended to be associated with a container.

[027] According to yet another aspect of the invention, a method of producing at least one decorative pattern on an object is provided. The method may include providing a support formed of molded material and depositing at least two superposed layers of metal on at least a part of a surface of the support. An outer layer of the at least two layers may be formed of a first metal. The method may also include eliminating a portion of at least the outer layer so as to reveal a portion of another layer formed of a second metal having at least one of a color and an appearance differing from that of the first metal, wherein the eliminated portion corresponds to a decorative pattern.

[028] According to a further aspect of the invention, the object may be configured in the form of a stopper for a container intended for packaging a cosmetic product. The object may further comprise a transverse wall and a lateral skirt extending from the transverse wall. The decorative pattern may be formed on at least one of the transverse wall and the lateral skirt.

[029] Apart from the provisions set out hereinabove, the invention may comprise a number of other provisions explained hereinafter with regard to some non-limiting exemplary embodiments described with reference to the figures. In the drawings,



[030] Fig. 1 is a schematic view of the main stages of marking an object according to one embodiment of the invention;

[031] Fig. 2A is a cross-sectional view of a galvanized (metallically coated) object prior to laser marking;

[032] Fig. 2B is a cross-sectional view of the object of Fig. 2A after laser marking according to one embodiment of the invention;

[033] Fig. 2C is a cross-sectional view of the object of Fig. 2A after laser marking according to yet another embodiment of the invention;

[034] Fig. 3 is an isometric view of an embodiment of an object to be decorated in accordance with the invention;

[035] Fig. 4 is an isometric view of an alternative embodiment of an object to be decorated in accordance with the invention;

[036] Fig. 5 is an isometric view of another alternative embodiment of an object to be decorated in accordance with the invention;

[037] Fig. 6A is an isometric view of an object decorated according to an embodiment of an invention; and

[038] Fig. 6B is a cross-sectional view of the object of Fig. 3A taken along line 6B-6B.

[039] As shown in Fig. 1, the object 1 to be decorated may be configured as a stopper intended for a container such as a bottle, jar, or case. This stopper 1 may be formed from a support 2, obtained by molding a galvanizable thermoplastic such as ABS.

The support 2 may comprise a cylindrical lateral skirt 3 of circular cross-section intended to engage with the neck of the container. One end of the lateral skirt 3 may extend from a transverse wall 4 of square cross-section, larger than the cross-section of the cylindrical lateral skirt 3. The lateral skirt 3 may have a different cross-section, such as a square or oval. The transverse wall 4 also may have a different cross-section, such as oval or circular.

[040] The support 2, once it has been molded, may then be passed through a series of baths so that its surface is covered, for example, by galvanoplasty, with a coating having a number of metal layers.

[041] Electrodeposition and galvanoplasty are techniques for metallicity coating an object by using the conductivity properties of the material of which the object is formed. In the case of galvanoplasty, the thermoplastics used may be made conductive by a multi-stage method during which the object to be galvanized is dipped in a series of baths.

[042] In a first stage, known as "staining," tiny roughnesses may be created on the surface of the object so as to generate anchoring points for the metal deposit. To do that, organic bridges in the object's structure may be broken down during this stage. In the case of materials containing butadiene, such as ABS, micro-spheres of butadiene lying at the surface of the material may be destroyed, thus giving way to micro-cavities intended to form such anchoring points.

[043] In a second stage known as "catalysis," stable colloidal palladium may be incorporated into the micro-cavities.

[044] In a third stage known as "acceleration," the protective colloid may be removed so as to activate the palladium.

[045] In a fourth stage, the object may be rendered conductive by an operation known as "chemi-nickel plating."

[046] Thereafter, electrolysis may be used to deposit one or more layers of metal onto the layer of nickel. For example, a layer of copper may be deposited, onto which a layer of nickel, bronze, chromium or gold may then be deposited. The layer of copper may have the function of strengthening and improving the rigidity of the thin nickel deposit.

[047] As can be seen in the cross-sectional view of the stopper 1, depicted in Fig. 2A, the galvanized coating may be formed of superposed layers, e.g., a layer 10 of nickel, a layer 11 of copper, and a layer 12 of chromium. The thickness of the three layers of metal Ni/Cu/Cr thus deposited may range from about 10  $\mu\text{m}$  to about 30  $\mu\text{m}$ .

[048] After this galvanoplasty stage, the cylindrical lateral skirt 3 of the stopper 1 may be decorated using a laser 7 of the Nd: YAG type. To do this, the surface corresponding to the area to receive the decorative pattern 6 may be swept with a laser beam 5 so as to literally "burn away" at least the outermost layer 12 on the object in the area to be decorated. Thus, in the example of the object including a layer 10 of nickel, a layer 11 of copper, and a layer 12 of chromium, the laser beam may remove at least the layer 12 of chromium on the surface corresponding to the decorative pattern 6 to be produced, thus revealing the decoration. A cross-section through the lateral skirt 3 of the stopper, after marking using the laser beam, is depicted in Fig. 2B. Because the layer 12 of

chromium has been removed from the surface corresponding to the decorative pattern 6, this surface therefore has the colors of the layer 11 of copper. Alternatively, it is possible to eliminate the two outermost layers, shown in Fig. 2C, thus revealing a nickel-colored decoration.

[049] As shown in Figs. 1 and 2A-2C, the decorative pattern 6 may be produced on the lateral skirt 3 of the object. Alternatively, as shown in Figs. 6A and 6B, the decorative pattern 6 may be produced on the transverse wall 4 of the stopper 1. As shown in cross-section in Fig. 6B, the surface corresponding to the area to receive the decorative pattern 6 may be swept with a laser beam 5 so as to literally "burn away" at least the outermost layer 12 on the object in the area to be decorated. Because the layer 12 of chromium has been removed from the surface corresponding to the decorative pattern 6, this surface therefore has the colors of the layer 11 of copper.

[050] According to one specific embodiment, the wavelength of the laser beam 5 may be about 1064 nm and its power may be about 9 W. The surface to be decorated may be located a distance of about 200 mm away from the laser, and the focal length may be about 160 mm.

[051] As shown in Figs. 3-5, the object 1 to be decorated may be a container or an accessory for use with a container. Referring to Fig. 3, the object 1 to be decorated may be a stopper 14 configured to fit on a container 13. As shown in Fig. 4, the object 1 to be decorated may be both the stopper 14 and the container 13 on which the stopper 14 is

placed, each including a decorative pattern 6, 6', respectively. Further, as illustrated in Fig. 5, the object 1 to be decorated may be the container 13.

[052] Optionally, the aesthetic appearance of the decorations obtained by implementing the method according to the present invention may be entirely compatible with the requirements of the market for goods known as "luxury goods," such as perfume or other cosmetic products of the same kind.

[053] In the foregoing detailed description, reference is made to some embodiments of the invention. It is obvious that variations can be made thereto without departing from the spirit of the invention as claimed hereinafter.